

A new species of the genus *Oestophora* Hesse 1907 (Gastropoda: Pulmonata: Helicodontidae) from the Upper Pleistocene of Mallorca (Balearic Islands, Western Mediterranean)

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A new species of the genus *Oestophora* HESSE 1907 is described from the upper Pleistocene of Mallorca (Balearic Islands, W Mediterranean). Initially, fossil specimens from Mallorca were classified as *O. barbula* ROSSMÄSSLER 1838 since they displayed two teeth in the aperture. The characters that differentiate more clearly the new species from *O. barbula* and other related insular species, all from the Plio-Pleistocene of Eivissa, Menorca and Sardinia are: 1) shell opening with a very extended palatal tubercle; 2) shell with an umbilicus very narrow (attaining only 1/7 of maximum shell diameter); and 3) shell keeled. The long period of isolation of the Balearic Islands since the middle Miocene and the drift of the Cirno-Sardinian massif during the Oligocene favoured differentiation and origin a new species on each island derived from the continental ancestors present in the east of the Iberian Peninsula and south of France.

Keywords: *Helicodontidae*, *Oestophora*, new species, Mallorca (Spain), upper Pleistocene.

UNA NOVA ESPÈCIE DEL GÈNERE *Oestophora* HESSE 1907 (GASTROPODA: PULMONATA: HELICODONTIDAE) DEL PLEISTOCÈ SUPERIOR DE MALLORCA (ILLES BALEARS, MEDITERRÀNIA OCCIDENTAL). En el present treball se descriu una nova espècie pertanyent al gènere *Oestophora* HESSE 1907 procedent del Pleistocè superior de Mallorca (Illes Balears, Mediterrània occidental). En principi, els exemplars fòssils de Mallorca havien estat classificades com a *Oestophora barbula* ROSSMÄSSLER 1838 en presentar dues dents en l'obertura. Els caràcters diferencials més clars que separen la nova espècie d'*O. barbula* són l'existència d'un tubercle palatal molt allargat, un llombríglol molt estret (1/7 del diàmetre major de la closca) i la closca aquillada. Aquestes característiques no sols diferencien aquesta espècie d'*O. barbula*, sinó també de la resta d'espècies insulars pertanyents al mateix gènere, amb representants que es coneixen del Plio-Pleistocè d'Eivissa, de Menorca i de Sardenya. El llarg període d'aïllament de les Illes Balears des del Miocè mig i el desprendiment de la microplaca cirno-sarda Durant l'Oligocè propicià, possiblement, l'aparició de noves espècies a cada una de les illes a partir de les espècies continentals presents en el Llevant de la Península Ibèrica i el sud de França.

Paraules clau: *Helicodontidae*, *Oestophora*, nova espècie, Mallorca (Espanya), Pleistocè superior.

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Introduction

The genus *Oestophora* Hesse, 1907 is now represented by ten species in the Iberian Peninsula, North Africa and the Azores (Puente, 1996). Several species have also been described or cited for the plio-Pleistocene of Mallorca (*O. barbula* Rossmäler, 1838), Menorca (*Oestophora* sp) and Eivissa (*O. dentata* Paul, 1984) (Gasull, 1963; Quintana, 1995; Paul, 1984) and Sardinia (*O. aff. kuiperi* Gasull, 1966) (Esu, 1978). Of these four species, only *O. dentata* has a clear taxonomic status and chorology. According to the figure in Esu (1978), it is possible that the species found in Sardinia is not *O. kuiperi* (recently synonymized with *Suboestophora boscae* [Hidalgo, 1869] which is endemic in the Eastern part of Iberia [Martínez-Ortí & Robles, 2002]), or it is an undescribed.

O. barbula is an Atlantic species mainly distributed in the Western half of the Iberian Peninsula (Puente, 1996). Its presence in the fossil registry of the Balearic Islands can be considered as surprising, since most of the native macromolluscs of the Balearic Islands are endemic (Pons & Palmer, 1996; Quintana, 2006a).

The first news on a fossil Helicodontidae in the Pleistocene of the Balearic islands were by Gasull (1963), who studied some shells gathered by Joan Cuerda in the subsoil of Palma de Mallorca and Sa Calobra (Escorca, Mallorca). These shells were referred to *O. barbula* thanks to the presence of two teeth in the side shell aperture. Gasull (1963) provisionally dated the specimens

from Sa Calobra back to the last interglacial period, during the upper Pleistocene.

Cuerda (1989), in its revision of the data published by Gasull (1963) on the deposits of the Balearic Pleistocene, listed *O. barbula* among the fossil terrestrial molluscs found in the archipelago. Very recent data are referred to a specimen found in the vicinity of Sa Pedra Foguera, which was classified as *Oestophora* sp. by Vicens & Pons (2004).

From this point of view, the existence of a new terrestrial molluscan species from the Pleistocene of Mallorca is more coherent from the historical and biogeographical point of view, since the malacological fauna of each island has evolved of isolated ways from the middle Miocene (Quintana, 2006b).

Methodology

The description of the new species is based on two specimens collected by Joan Cuerda in Sa Calobra (Escorca, Mallorca) and one more recent collected specimen from Alcudia (Mallorca). It has not been possible to locate the specimen found in the subsoil of Palma de Mallorca mentioned by Gasull (1963).

The three fossil specimens from Mallorca (preserved in the *Museu de la Naturalesa de les Illes Balears-Societat d'Història Natural de les Illes Balears* - Palma de Mallorca, Spain) (acronym MNIB-SHNB) have been compared with specimens of *O. barbula* coming from Eiras

(Goián, Pontevedra, Galicia), mount of Santa Tecla (Vigo, Pontevedra, Galicia), Membrillo Alto (Zalamea la Real, Huelva), Setúbal (Portugal) and Ribera del Sil (Mogote de Lemos, León), *O. silvae* (Ortiz de Zárate, 1962), from the Fuentona de Ruente (Cantabria), *O. lusitanica* (Pfeiffer, 1841) from A Castiñeira (Montederramo, Ourense, Galicia), *O. dorotheae* (HESSE 1930) from Morocco and *O. ortizi* De Winter & Ripken, 1991, from Alhaurín de la Torre (Malaga).

O. cuerda sp nov, also has been compared with figures in Paul (1984), Paul & Altaba (1992) and Esu (1978) respectively of *Oestophora* sp from the Pliocene of Punta Nati (Ciutadella de Menorca) (Quintana, 1995), *Oestophora* aff. *kuiperi* (sensu Esu, 1978) from the Plio-Pleistocene of Sardinia and *O. dentata* PAUL 1984 from the Pleistocene of Eivissa (Balearic Islands). The measurements of all the shells were made with a digital caliper. The number of whorls of the shell was calculated after Herbert & Kilburn (2004). The inclination of the aperture in relation to the vertical axis of the shell was estimated from photographs.

Geologic context

The holotype of the new species comes from a deposit of the upper Pleistocene with a well defined stratigraphic sequence, located in the north of the Serra de Tramuntana (Mallorca), on the slope facing the bay of Alcudia. Here the continental deposits are formed by aeolianites, silts and breccias (colluvial deposits) attached to the Mesozoic and Miocene limestones. The holotype comes from level D (see Vicens & Crespi, 2003: p. 124 for additional details).

The deposit of Sa Pedra Foguera can be dated back to the upper Pleistocene, although in the absence of absolute datings, it is difficult to establish in which isotopic sub-stage level D is included. In relative terms, level D could be dated near the isotopic sub-stage 5d. Vicens *et al.* (2006) describe two nearby deposits with marine fauna pertaining to this isotopic sub-stage, located below the continental deposits of Sa Pedra Foguera.

Systematic study

Order Pulmonata Cuvier in Blainville 1914
Family Helicodontidae Kobelt 1904
Genus *Oestophora* HESSE 1907
Oestophora cuerda nov. sp.

List of Synonyms

Oestophora (*Oestophora*) *barbula*, Gasull, 1963, non Rossmässler, 1838: Bolletí de la Societat d'Història Natural de les Balears, 9 (1-4), 81-82.

Oestophora barbula, Cuerda, 1989, non Rossmässler, 1838: Los Tiempos Cuaternarios en Baleares, 243-244. Fig 5, lám. 13.

Oestophora sp, Vicens, D. & Pons, G.X. (2004): IV Jornades de Medi Ambient de les Illes Balears. Ponències i resums: 103.

Holotype: MNIB-SHNB-2791, from the vicinity of the pleistocenic deposit at Sa Pedra Foguera, level D (Alcudia, Mallorca) (fig 1A). Dimensions of holotype. Diameter: 9.66 mm; height: 4.69 mm; inclination of the aperture: 29°.

Paratypes: Collection Joan Cuerda, MNIB-SHNB-2792, adult shell, well preserved (fig 1B), diameter: 10.91 mm, height: 5.32 mm,

aperture inclination: 39°; collection Joan Cuerda, MNIB-SHNB-2793, juvenil shell, with part of the aperture missing, from Sa Calobra (Escorca, Mallorca, Illes Balears).

Type locality: in the vicinity of the cave of Sa Pedra Foguera, level D, formed by breccias with mainly centimetric clasts in a reddish silty matrix, with potency between 1 and 1.5 m. Other endemic snails are abundant. Next to *O. cuerdai* they appear *Iberellus balearicus* (Rossmässler, 1838), *Tudorella ferruginea* (Lamarck, 1822), *Xerocrassa frater* (Dohrn & Heynemann, 1862), *Oxychilus (Ortizius) lentiformis* (Kobelt, 1882) and *Chondrula* sp.

Derivatio nominis: dedicated to the memory of our dear friend Joan Cuerda Barceló, distinguished quaternarist of the Balearic Islands.

Diagnosis. Shell with sharper keel; shell opening with very long palatal tooth; near the aperture, the last whorl is narrower than the penultimate one.

Differential diagnosis. *O. cuerdai* is clearly differentiated from of *O. barbula* by the narrower mouth, which is less rounded and less inclined in respect to the vertical axis of the shell (Table 1). The palatal tubercle is longer in *O. cuerdai*; the umbilicus and the last whorl are proportionally narrower. The shell has a sharper keel (Fig. 1). Unlike *O. cuerdai*, the profile of the shell in *O. silvae* and *O. lusitanica* is rounded, the umbilicus wider and the mouth has no teeth. *O. calpeana* and *O. dorotheae* have a keeled shell (Puente, 1996) as it happens in *O. cuerdai*. Nevertheless, neither of these two species displays denticulation in the aperture. *O. ortizi* and *O. granease* Arrébola, 1998 display an umbilicus as narrow as that of *O. cuerdai*. Nevertheless, neither species has a keeled shell or denticulation in the aperture (DE Winter & Ripken, 1991, Arrébola, 1998). *O. cuerdai* differs from *O. dentata*, *Oestophora* sp from the Pliocene of Punta Nati and *Oestophora* aff. *kuiperi* sensu Esu, 1978 by the keeled shell, the last whorl being narrower than the penultimate and the umbilicus proportionally narrower.

		A		B		C	D		E	F
	n	Max.-Min.	X	Max.-Min.	X		Max.-Min.	X		
<i>O. cuerdai</i>	2	10.91-9.66	10.28	5.32-4.69	5.00	1/7	39°-29°	34°	6 ½-7	2
<i>O. barbula</i>	68	12.39-8.76	10.77	5.92-4.10	5.08	1/4-1/5	48°-35°	43°	5 ¼-5¾	2
<i>O. dentata</i>	1	12.50	-	6.3	-	1/3-1/4	46°	-	5,5-6	1
<i>Oestophora</i> sp	2	13.97-13.74	13.85	8.04	-	1/3	58°-57°	57,5°	7-7 ¾	?
<i>O. aff. kuiperi</i>	1	8-9	-	4	-	1/3	?	-	5 ¾	0

Table 1. Conchological dimensions (in mm) and characters of *O. cuerdai* compared with those of *O. barbula* and the three fossil species: from Eivissa (*O. dentata*), Menorca (*Oestophora* sp.) and Sardinia (*Oestophora* aff. *kuiperi* sensu Esu, 1978), from our own data and from PAUL (1984) and ESU (1978). The diameter of the umbilicus and the number of whorls of *O. barbula* come from MANGA (1983). In this species, the inclination of the mouth in relation to the shell vertical axis of the mouth is for 14 specimens. A: diameter; B: height; C: umbilicus diameter; D: aperture inclination of mouth; E: number of whorls; F: number of teeth.

Taula 1. Dimensions de les closques (en mm) i característiques d'*O. cuerdai* comparada amb *O. barbula* i les tres espècies fòssils: d'Eivissa (*O. dentata*), de Menorca (*Oestophora* sp.) i de Sardenya (*Oestophora* aff. *kuiperi* sensu Esu, 1978), segons les nostres dades, així com de Paul (1984) i Esu (1978). El diàmetre del llombrícol i el nombre de voltes d'*O. barbula* ve donat per Manga (1983). En aquesta espècie, el valor mig de la inclinació de la boca en relació amb l'eix vertical de la boca ha estat calculat a partir de 14 exemplars. A: diàmetre; B: altura; C: diàmetre de la guixa; D: inclinació de l'obertura de la boca; E: nombre de voltes; F: nombre de dents.



Fig. 1. A: MNIB-SHNB-2791, holotype of *Oestophora cuerda* n. sp. from level D of the pleistocenic deposit at Sa Pedra Foguera (Alcudia, Mallorca). Shell diameter: 9.66 mm; B: MNIB-SHNB-2792, Paratype of *Oestophora cuerda* from the Pleistocene at Sa Calobra (Escorca, Mallorca). Shell diameter: 10.91 mm; C: *Oestophora barbula* from Eiras (Goián, Pontevedra). Shell diameter: 11.95 mm.

Fig. 1. A: MNIB-SHNB-2791, holotípus d'*Oestophora cuerda* n. sp. Correspondent al nivell D del depòsit Pleistocènic de Sa Pedra Foguera (Alcúdia, Mallorca). Diàmetre de la closca: 9.66 mm; B: MNIB-SHNB-2792, Paratípus d'*Oestophora cuerda* del Pleistocè de Sa Calobra (Escorca, Mallorca). Diàmetre de la closca: 10.91 mm; C: *Oestophora barbula* d'Eiras (Goián, Pontevedra). Diàmetre de la closca: 11.95 mm.

Description. Shell lenticular, formed by $6\frac{1}{2}$ - 7 slightly convex and slow growing, whorls, separated by well-marked sutures. Last whorl keeled, narrower than penultimate. Shell surface with well defined, regularly spaced riblets. Lower side part of shell near the umbilicus with less evident ribs. Umbilicus narrow, cylindrical, partially covered by columellar side of peristome, its diameter $\frac{1}{7}$ of maximum shell diameter of the shell. Aperture narrow with two teeth: palatal tooth longer than basal. Teeth invisible outside. Peristome reflexed somewhat thickener in correspondence of internal teeth.

Inclination of aperture between 29° and 39° in relation to vertical axis of shell.

Distribution. Species endemic of Mallorca (Balearic Islands) (Fig. 2).

Biogeographical implications

The first representatives of the genus *Oestophora* appear in the lower Oligocene of Europe and NW Africa, and are also present in the lower Miocene of France (Zilch, 1960; Rey, 1974). *Oestophora* sp has also

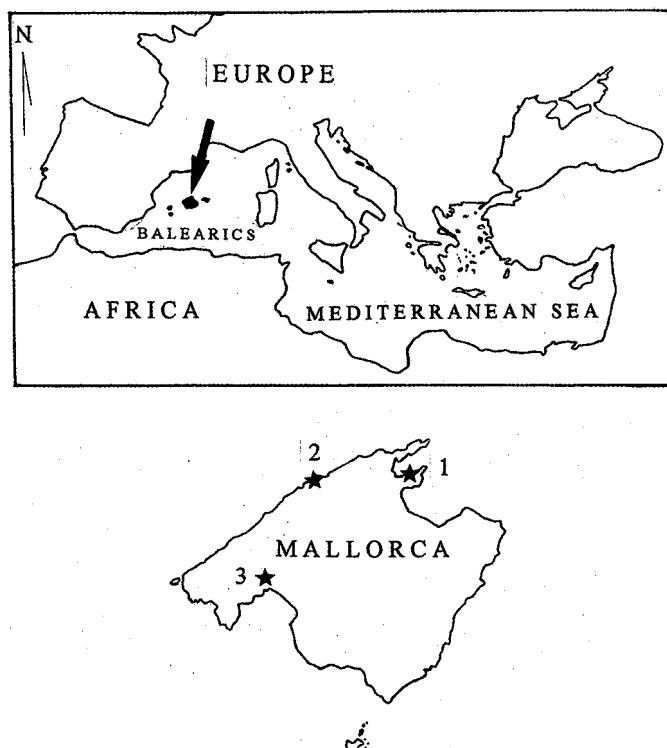


Fig. 2. Location of the Pleistocene deposits with *Oestophora cuerdai* n. sp. 1: Sa Pedra Foguera (Alcudia) (type locality); 2: Sa Calobra (Escorca); 3: Son Dureta (Palma de Mallorca).

Fig. 2. Situació dels dipòsits Pleistocens amb *Oestophora cuerdai* n. sp. 1: Sa Pedra Foguera (Alcúdia) (localitat típica); 2: Sa Calobra (Escorca); 3: Son Dureta (Palma de Mallorca).

been found in the continental deposit of the upper Miocene at Can Llobateres (Barcelona), and in the marine Pliocene of Papiol (Barcelona) and in the Northeast of the Iberian Peninsula (unpublished data). At present, the genus *Oestophora* is known to live in the Iberian Peninsula, North Africa and the Azores (Puente, 1996) As a Plio-Pleistocene fossil, *Oestophora* has a wider distribution, with Sardinia as its eastern most limit. The presence of this genus in the Balearic Islands and Sardinia can be explained from a paleogeographic point of view, since during the Oligocene, the Balearic Islands, Corsica and Sardinia were part of the palaeuropean continent with the

Iberian Peninsula and southern of France. The first terrestrial faunas with clear insular characteristics appear in the Balearic Islands during the Miocene (Mein & Adrover, 1982; Quintana & Agustí, in press). No doubt, the long period of isolation of the Balearic Islands favoured distinct speciation processes in the single islands. *O. cuerdai* displays the most peculiar characteristics. It is the only one with shell keeled and characterized by a very narrow umbilicus and two teeth in the aperture. Such characters clearly distinguish it from the other three insular species, which have a shell with a rounded profile, wide umbilicus and an aperture without teeth.

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